Distribution Network Planning & Inventory Optimization Supported by Simulation

Presentation summary

Why this case study?

Project background & modeling task definition

Modeling replenishment in supply chain

(Big) data issue at validation and scenario analysis

Model video

Modeling results / value for the client

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Why this case study?

1. Share our experience in real supply chain simulation modeling
2. Combination of AnyLogic model and advanced data analysis technologies
3. Give an example of real value brought to the client by simulation
Project background

Background:
• Diageo Russia – one of Russian top-5 wholesale alcohol beverages distributors
• Low-margin business very sensitive to customer service level and logistic costs

Issues & challenges:
• Increase of logistic costs per unit sold even with growth of sales volume
• Plans of expansion outside European Russia to Urals and Siberia
• Plans of opening a new factory in Russia

Consulting project tasks:
• Show and prove the ways to decrease logistic costs
• Choose logistic network configuration for the expanded client network
Why simulation

Product 1

Target stock level

Forecasting accuracy

Network configuration

Ordering frequency

Stock volume

Service level

Logistic costs
Simulation task definition

- For every logistic network configuration determine how forecasting accuracy and target stock level influence logistic costs and service level.

```
Configuration 1
Configuration 2
Configuration 3
Forecasts, Acc., Costs
```

```
Target stock level
Service level
Costs
Forecasting accuracy
```
Supply chain at a glance

3 existing and 1 prospective factories
3 existing and 5 prospective warehouses
Up to 300 demand points grouped into 45 service groups
3 border crossing points
2 customs offices

Replenishment algorithm
Order aggregation algorithm
Delays at border crossing points

218 product types, 6 types of warehouse operations
Transportation load building algorithm
Complete costing for every delivered product unit
Demand: different sales forecast accuracy for every product
Requirement distribution

Other warehouse
40%
Consolidation warehouse
60%
Central DC
Demand forecast
100%
Regional DC
Demand forecast

Demand forecast

5 days

Consolidation warehouse
Regional DC

Requirement diagrams

x 60%

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Replenishment algorithm

Requirement (demand) diagram

Replenishment planning horizon

Requirement
Current stock
Expected deliveries
Replenishment sources
• Lead time
• Min order size
• Proportion

Replenishment algorithm

Actions to prevent coverage gaps:
• New orders
• Moving orders earlier / later
• Increase order quantity
• Use emergency replenishment source

Stock diagram

40 pcs

40 pcs
Model validation

Model validation plan

- Initial stock
- Target stock levels, tariffs
- 2012 demand forecast

Model

Modeled data
Actual data

≤5%

SAP ERP system

Demand volume → Replenishment volume → Stock volume → Stock value

Logistic costs
Obstacle with too much data

Stock level at Moscow Warehouse

Actual data
Modeled data

- What is the structure of the number?
- What products have stock lower than actual?
- Did we order less than it was required? Why?

- Re-launch model
- Stop experiment at certain moment
- Look at model state in AnyLogic
- Implement a new report in AnyLogic
New model structure

**Before**

- AnyLogic 6 Model
  - Loading
  - Main model logic
  - Export modeling results to Excel

**After**

- AnyLogic 6 Model
  - Loading
  - Main model logic
  - Logging

- Deductor
  - Data processing scenario
  - Logs

- VBA
  - Macro
  - Reports

Scenarios: XLSX

Reports: XLSX

Logs: TXT

Presentation: PPTX

Reports: XLSX

Macro: TXT

Data processing scenario: TXT

Logs: TXT
Advantages of the new model structure

- Experiment run time decreased 5 times
- Up to 3 times less effort to prepare presentation for project team meetings
- Modification of reports without editing the model in AnyLogic. Simulation modelers and business consultants can work separately!

- Less time for model validation
- More attention to business consulting
- More supply chain options considered
Model video
Stock at different forecasting accuracy

Stock at consolidation warehouse, 80% Accuracy

Stock at consolidation warehouse, 40% Accuracy

Upper stock threshold

Stock level

Lower stock threshold
Service level vs. target stock & accuracy

Configuration 1

Forecasting Accuracy

Configuration 2

Configuration 3

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Consolidation of simulation results

Logistic costs per product unit vs. Service level, %

- **AS-IS**
- **TO-BE**
- **Best**

- **Accuracy 95%**
- **Accuracy 80%**
- **Accuracy 60%**
- **Accuracy 40%**

Bubble size: target stock level
Business recommendations

- Pay-off period of initiative for increase sales forecasting accuracy from 60% to 80% is less than 2 years
- 20% increase of forecasting accuracy will allow to reduce target stock level by 40% which will reduce logistic costs per unit by 7%
- Opening regional warehouses will require unreasonably big stock to maintain target service level
Conclusion

• Experience shows that development of flexible and re-usable models needs coding. Support of using programming is an advantage of AnyLogic

• Model validation and scenario analysis require a lot of effort for data transformation and representation. Adding wider support of data-related operations into simulation tools would increase the efficiency of simulation projects